Orion Pad Abort 1 Crew Module Inertia Test Approach and Results

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Abstract

The Flight Loads Laboratory at the Dryden Flight Research Center conducted tests to measure the inertia properties of the Orion Pad Abort 1 (PA-1) Crew Module. These measurements were taken to validate analytical predictions of the inertia properties of the vehicle and assist in reducing uncertainty for derived aero performance results calculated post launch. The first test conducted was to determine the Ixx of the Crew Module. This test approach used a modified torsion pendulum test step up that allowed the suspended Crew Module to rotate about the x axis. The second test used a different approach to measure both the Iyy and Izz properties. This test used a Knife Edge fixture that allowed small rotation of the Crew Module about the y and z axes.

Discussions of the techniques and equations used to accomplish each test are presented. Comparisons with the predicted values used for the final flight calculations are made. Problem areas, with explanations and recommendations where available, are addressed. Finally, an evaluation of the value and success of these techniques to measure the moments of inertia of the Crew Module is provided.